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dam will conserve water power and prevent floods, but at the same time may not preserve a wildlife sanctuary or an area of scenic beauty. It seems to me we must relate conservation to ecology in order that the true cause of conservation is not lost.

Our course in Conservation and Field Biology may appear to some as a "hybrid" when we teach both conservation and ecology. In my opinion it has been serving a real need and is stimulating a great deal of interest. We want to involve as many of our liberal arts students as possible. This becomes especially important in recent years when a much higher percentage of our student body is coming from the arge urban centers. During recent discussions on changes in our curriculum a segment of our faculty advocated a course in conservation as required for graduation. This interest, I am sure, has come about to a great extent because of feature articles which are appearing in some of our journals such as the Saturday Review and others.

Management of Natural Landscapes in Iowa: An Appraisal

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Abstract. The management of natural landscapes must be based on well defined objectives and sound operational techniques. Both of these have been lacking in many situations in Iowa. Examples are presented, and proposals are suggested for an effective program.

Management of anything implies a set of values associated with the thing being managed. It assumes a control, partially at least, over the occurence of undesirable events as well as a control, partially at least, over desirable events. Management is successful or unsuccessful depending on whether or not the objective is or is not achieved. Management then does not define the objective, but the objective should define the management.

Some more definitions are in order. *Natural* is intended to mean anything which is largely unaffected by man. In it strictest sense there are no natural areas of vegetation remaining in Iowa, but in a relative sense there are many areas which are natural, in that their present structure and composition are largely unaffected by man. I have used the word *landscape* in the fullest sense to mean the surface features of an area including the

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physical features of the land and water, plants, and animals. It is broader in scope than plant community and less troublesome in definition than ecosystem. In other words *management of natural landscapes* means the manipulation of various components or conditions in areas, presently showing little influence by man, toward specific objectives one of which usually includes a retention of naturalness. Such areas are known more commonly as native prairie, oak woodland, river forest, marsh, bog, etc.

There seems to be something incompatible in the title. How can man possibly manage an area and still call it a natural area? On the one hand is *management,* which involves man; on the other is *natural,* which largely excludes him. Of course it is relative, and the determination of what is *natural* after all is often disconcerting. For example, one of the features of early Iowa was the prairie landscape which spread over most of the state. Lightning fires occurred in this grassland even before the influence of the earliest man. These fires were natural, and they have largely been restricted or completely excluded in our present management. This protection from fire that we impose on some of our natural landscapes is a type of management. Does it discriminate against the natural community itself, whatever it was, so that in the prairie remnants we often see a gradual invasion of forest species? (Aikman 1955).

The Problem of Determining Objectives

Management of natural landscape is based on two assumptions: 1) that the objectives can be defined, and 2) that once defined, the knowledge is available by which these objectives can be accomplished in a series of manipulations. The first of these is not without serious difficulty. Not only are there different values placed on a natural landscape by different groups of people, but these values change constantly with time as human values and populations change, and as the natural landscapes themselves change (Egler 1964).

Let us take a hypothetical example and see how the objectives might be determined. Suppose we consider the management of a natural landscape unit consisting of about one mile length of a small stream valley in central Iowa. A very small amount of bottomland is present, mostly cultivated; the valley slopes are covered with a mature forest of maple, oak, hickory, ash, walnut, and other trees; the slopes change abruptly into open oak woodland, patches of native prairie, pastures, and finally into the completely cultivated, rolling uplands. Now privately owned, but available for public purchase, this area has been used occasionally by fishermen, squirrel hunters, mushroom collectors,

garden clubs for the abundance of spring wildflowers, biology classes, and probably many other individuals and groups. What objectives would we define for the future use of this area if we were planning for the public benefit? Obviously one objective would be to preserve it as it is, a self-sustaining remnant of natural landscape, with no further development than to fence it and set up some way of protecting it from exploitation by irresponsible individuals. However, it would make a beautiful small lake, which would be rapidly filled with fishermen if given a chance, or water sportsmen of another sort if access is adequate for power boats. Cottage sites in the timbered portion would be dreamy, and so would camping facilities. There is a lot of valuable timber that could be harvested to pay for some of the cost of development. There are many possibilities. Some of them are clearly incompatable. Often the objectives which dominate the development and management of an area such as this are not based on a rational approach at all but on profit to the developer and on specially vocal groups who will also benefit. Our natural landscape becomes the center of controversy, its future to be determined by power rather than rationality.

This is not a local issue, it is nation-wide. One can examine literature from nature oriented groups such as The Nature Conservancy, the Sierra Club, The Wilderness Society, National Wildlife Federation, etc., and see the concern over the expression of one objective, that is the preservation of natural landscapes. To name a few national controversies at the present time, we have the conflict of interest over the Boundary Waters Canoe Area in northern Minnesota, proposed construction of the Rampart Dam in Alaska, the Redwood National Park proposal in California, proposed construction of the Trans-mountain Road in the Great Smoky Mountain National Park, and Proposed construction of Bridge Canyon and Marble Canyon dams on the Colorado River to affect the Grand Canyon National Monument Park (Brandborg 1966).

A rational definition of objectives for our hypothetical case as well as the national cases cannot be determined until some consideration is given to surrounding public areas. Abundant areas of similar natural landscapes would reduce the pressure to set aside another area for preservation. However, as scarse as this landscape is in central Iowa, it is rational to insist on some definition which includes preservation of the naturalness of the small valley. The inestimable value of these irreplaceable natural areas is becoming obvious to knowledgeable people more and more, but this will not be discussed further in this paper.

The Problem of Management

Once the difficult definition of objectives has been determined for an area, the second aspect of management must be considered—that we know how to manipulate things to attain the objectives. I am concerned with the problems of management of areas for naturalness; other possible objectives are not going to be considered here.

What information is required to develop manipulative techniques for the management of natural landscapes? A review of this question by Stone (1965) gives us an idea that most of our attempts up to now have been bull-in-the-China-shop manipulations. The best technique has been the least. But the management of natural landscapes even if it is *no management* must consist of those actions which are necessary to achieve our objective. The definition of these actions is dependent upon our state of knowledge of the organisms involved. In most cases it is woefully inadequate.

The sophisticated approach to the problem of gaining information presented by Stone is summarized here. A characterization of the landscape unit is paired with the characterization of the ecological potential of the species involved. Because vegetation is constantly changing, this characterization must consider the ability of plant and animal species to 1) occupy positions along physical and chemical gradients in the system, 2) modify environmental gradients on which they have become established, 3) survive under various form of competition, and 4) withstand fire and environmental extremes. Characterization of the environment is likewise important so that some estimate of successional trends over the area can be made.

A digression is necessary. If our objective is vegetation preservation, then are we not obliged to preserve examples of successional stages as well as the mature vegetation? The floating bog in Pilot Knob State Park is temporary in a sense, but isn't it a significant feature of that unique natural area which should be maintained? What about grassy balds along forest ridges which are losing out to woody plant invasion? Also, the magnificent white pines in White Pine Hollow State Park are subject to replacement by maple if present trends reported by Cawley (1965) continue.

Returning to Stone's suggestions, it seems necessary to develop techniques that can control the successional force without upsetting the relationship between other organisms in the ecosystem. Then by operational testing, joined with continual inventory, the manipulative techniques can be applied with some degree of confidence that the objective may be reached.

The management of marshes in Iowa is an example of the beginning of sophistication that is necessary for management of a natural landscape (Weller 1966). Weller reveals the consternation of the manager over the conflict of interests which occur when an area is being managed. Information gained from life history studies of marsh plants and animals, water and soil, backed with considerable experience is responsible for the general formula for marsh management which Weller proposes. Other areas are in need of similar attention.

Appraisal and Proposals

My superficial criticism of the present management of natural landscapes in Iowa is combined with a series of four proposals which I consider to be absolutely essential for the future of natural resource conservation. I do not agree with those who define conservation as a minor slowdown in the exploitation of natural resources, although it seems to me that this is the definition under which we are now operating in the state.

Proposal 1—*that permanent objectives be defined for specific areas of natural landscapes in the state so that management can be directed toward these goals.* If the purpose of maintaining Pilot Knob State Park is for its unique natural features (which was the original intent in its preservation), pressure groups should not be allowed to transform it into a commercial ski development. If Woodman Hollow on the Des Moines River is to be defined as a wilderness preserve, it should be managed for that purpose, not as a gradually expanding camp ground. If Hayden Prairie is defined as a Natural History Preserve, it should not be managed only for the purpose of improving pheasant habitat, nor be mowed at the convenience of the hired man rather than at the recommended time for maintaining vigor and variety of prairie species.

Proposal 2—*that where conflicts in interest develop over the definition of objectives, the objective whose manipulative action modifies the area the least amount would have first priority.* To control the incidence of Dutch elm disease in some cities, it has been suggested that it might be helpful to remove infected and susceptible trees from natural areas in local parks. Until this can be shown to be definitely effective, the natural area should not be subjected to the cutting and burning. In this case the definition of *naturalness* is arbitrary because of the introduction of the disease into this country by man; however, the area with standing dead elms would be sounder ecologically than the one in which they were mechanically removed at various levels of infection.

Proposal 3—*that funds supporting research in natural life history studies and in ecosystem dynamics should be greatly increased.* We do not have the basic information in most cases to give much more than stop-gap advice on management of natural landscapes. Any action that is done usually sets off a sequence of events most of which are unpredictable at our present state of knowledge. Is fire essential for the management of tall grass prairie in Iowa? It seems so. Are animal inhabitants able to recover from this natural disaster in the small units of prairie landscape that we are attempting to preserve? Many questions of management are unanswered.

Proposal 4—*that educational support be given more broadly in all areas of natural history not dwelling predominantly on the traditional areas of hunting and fishing conservation.* Management of natural areas is ultimately the management of people. Only those who understand the significance of all forms of life in their environment can grasp the purpose of natural landscape preservation and make sound decisions affecting the use of natural resources in a democratic society.

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A Discussion of the Economic Basis for Paid Hunting on Farm Land

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Abstract. Farmers are the nation's principal wildlife managers. They control production, growth, and harvest of wildlife on about 76% of the land. The farmer assigns a personal value to wildlife and regulates its abundance accordingly. His need for game and non-game animals is largely supplied by the amount produced as a by-product of his normal farming activities. The presence of wildlife in numbers greater than the farmer's needs produces conditions that adversely affect the farm business. An example is given of the costs associated with intentional management for wildlife and paid hunting on a typical Midwest farm. The farm of 200 acres is under intensive cultivation and

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